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8 parts
1Lighting System

The present invention relates to lighting systems, particularly though not exclusively for use in emergency pathways.

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Existing emergency pathway lighting systems typically consist of a linear system whereby one section of pathway lighting supplies power to the next section. The creation of an illuminated pathway is therefore reliant on links between pathway modules. Generally, printed circuit boards, housed in pathway modules, adjoin each other via wire connections and therefore have an electrical means of interconnection. A central power supply unit, generally connected to the mains supply, supplies power the first lighting module, which in turn supplies power to the second lighting module, and so on. The power supply also has a battery back-up unit that is activated when there is a mains failure.

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However, the prior art has many potential failure points. The presence of water in the central power supply, containing the emergency battery back-up could cause the back-up to short circuit, resulting in a complete failure of the pathway system. If either the electrical supply line from the battery back-up to the pathway system or any of the pathway modules links suffer a breach, then a failure of the pathway system from the point of breach will occur. If any individual pathway lighting module suffers from electrical damage, then the subsequent modules would fail.

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The object of the present invention is to provide an improved lighting system.

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According to the invention there is provided a lighting system comprising:

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- a carrier for a primary source of electricity, including a plurality of primary coils;
- a plurality of sealed lighting modules, each including
 - at least one secondary coil, each for electro-magnetically linking with one of the primary coils; and
 - at least one light source.

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While the primary source of electricity will generally be mains electricity, it may be any other electricity source. For example such as produced by a generator, or the main supply on a ship or an aircraft, or from a step down voltage from the mains.

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Usually each lighting module will include a battery back-up, preferably together with suitable switch-over circuitry, such that if the primary source of electricity fails, the lighting module will function on battery power. Generally charging circuitry will also be provided for the battery.

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Conveniently each lighting module can further be provided with rectification means, such that if the primary source of electricity is of ac this can be converted to dc for the light source, if necessary.

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Typically the light source is at least one LED. For use as an emergency pathway lighting the light sources may be in the form of shapes. Advantageously the shapes are directional arrows. Alternatively the shapes are pictograms, for example indicating the position of a fire escape or fire extinguisher. In another alternative the shapes can words.

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The modules are adapted to be housed in continuous castings.

According to a second aspect of the invention there is provided a sealed lighting module for use with a carrier for a primary source of electricity, and having a plurality of primary coils, the lighting module comprising;

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- a least one secondary coil for electromagnetic induction from a primary coil; and
- at least one light source.

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Usually each lighting module will include a battery back-up, preferably together with suitable switch-over circuitry, such that if the primary source of electricity fails, the lighting module will function on battery power. Generally charging circuitry will also be provided for the battery.

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To help understanding of the invention, a specific embodiment thereof will now be described by way of example and with reference to the accompanying drawings, in which:

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Figure 1 is a schematic diagram of a lighting system according to the present invention;

Figure 2 is a circuit diagram of a lighting module of the lighting system of Figure 1;

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Figure 3 shows various formations for a carrier of the lighting system of Figure 1;

Figure 4 shows various options for light source arrangement;

Figure 5 is perspective view of a first embodiment of a lighting system of the invention;

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Figure 6 is a front view of a second embodiment of a lighting system of the invention;

Figure 7 shows a variety of tracks for holding the lighting system;

Figure 8 is a lighting module in the shape of a standard light bulb;

Figure 9 is a lighting module in the shape of a baton;

Figure 10 is a further lighting module incorporating a reflector;

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Figure 11 is a large lighting module designed for downward and outward lighting;

Figure 12 is an end view of the lighting module of Figure 11;

Figure 13 is a bottom view of the lighting module of Figure 11; and

Figure 14 is a perspective view of the lighting modules of Figure 11.

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Referring to the drawings, Figure 1 shows the lighting system of the invention
1. A carrier 10 is provided for supplying mains electricity 11 to the system 1.
5 Positioned along the carrier are primary coils 12. The primary coils are fully
encapsulated in the carrier and as such cannot be adversely effected influx of water,
for example during an emergency. The carrier is made from a suitable thermoplastic
such as polycarbonate or polypropylene.

10 The system also includes lighting modules 20. The modules 20 include
secondary coils 22 which electro-magnetically link to the primary coils 12 for
inducing electricity flow in the lighting modules 20. Battery back up 26 is also
provided in the modules 20. The carrier assembly also includes voltage-conditioning
circuitry 14.

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The lighting modules 30 are designed to be sealed units to prevent the ingress
of water or noxious gases that may cause failure of the circuitry. Thus if the mains
electricity fails, the lighting modules 30 will continue to function. This is important
20 in an emergency situation, such as a fire, where it is important to direct people to the
nearest exit or safety point.

Figure 2 shows in larger scale from Figure 1, the positioning for
electromagnetic induction between the primary coils 12 and the secondary coils 22.
25 As discussed above, fully encapsulating the primary coils 12 and providing the
secondary coils 22 in the fully sealed lighting modules, prevents the system from
being susceptible to the ingress of moisture. Flow of electricity is induced in the
secondary coils 22 by induction from the flow of electricity in the primary coils 11,
and as a result, both the primary coils 11 and the secondary coils 22 can be sealed and
30 thus impervious to water.

As shown in Figure 3, the lighting modules 20, further include rectification
means 24 for converting the ac current of the mains supply to dc current. A battery
back up 26 is provided in each lighting module 20, such that in the event of mains

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failure, the lighting module can be powered by the battery 26. Change over circuitry 28 is provided to enable to battery to be charged when the mains electricity is functioning, and to power the lighting module in the event of failure thereof.

5 In an alternative, the battery and charging circuit can be provided as an "eco battery" whereby the light sources in the lighting module runs on the power provided by the battery. When the power in the battery falls below a predetermined level when the charging circuit switches to the re-charge the battery and power the light sources via the secondary coils.

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The lighting modules include light sources 30. Typically, these will be LEDs. As shown two LEDs 30 are provided with a rectifier 31 to as voltage protection. However, other light producing devices such as standard light bulbs 33 or fibre optics can be used. Reflectors (not shown) may also be provided. As shown the lighting
15 modules additionally include a sounding device 32 and sockets 34 for the connection of other devices. All the components are mounted on a printed circuit board.

Figure 4 is shows the system of the invention in use with a series of sealed lighting modules 20 each housing an array of lighting elements 30. Each lighting
20 module 20 is positioned with its secondary coil 22 arranged for electromagnetic induction from the primary coils 12 encapsulated in the carrier 10.

One of the main advantages of the system of the present invention is that the lighting modules can be provided in a variety of different shapes and designs for use
25 in particular situations or places. Figures 5-14 give examples of particular lighting modules.

Figure 5 shows a variety of tracks including the carrier can be provided for accommodating the lighting system. Figure 5a is a carpet to smooth floor track;
30 Figure 5b is a carpet to carpet track; Figure 5c is a carpet to wall track; Figure 5d is a universal track; Figure 5e is a corner track; Figure 5f is a ramp track; Figure 5g is a hand rail track; and Figure 5h is a stair capping track.

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Figure 6 shows different arrangements of light sources from a secondary coil

12. Figure 6a shows five light sources 30 arranged on a board 60 in the shape of a right angle or possible arrow head. Figure 6b shows the light sources 30 arranged on a board 62 in the shape of a cross; and Figure 6c shows the light sources arranged on a board 64 in the shape of a T-piece.

Figure 7 is a bulkhead-type lighting module. As described above, the module 70 is a sealed unit and is provided with a secondary coil 72 for the electromagnetic induction from the primary coil in a carrier (not shown). In addition back-up batteries 74, and a battery indicator, 76 are provided. Light sources 78 are also provided with a reflector 79 to enhance and direct the lighting effect therefrom.

Figure 8 is a further lighting module, this time in the shape of a standard large light bulb 80. As before the module includes a secondary coil 82 for interaction with a primary coil on a carrier 83. Back-up batteries are provided inside the unit (not shown) and a battery indicator light is also provided 84. LED light sources 86 are provided on a printed circuit board 87 beneath a lens face 88. The choice of lens can result in the module being either a flood light, a spot light, a beam light or the like.

In the embodiment shown in Figure 9, a lighting module is shown in the shape of a tubular light bulb 90, or batton. It is provided with a secondary coil 92 for connection with a primary coil of a carrier (not shown). The body 94 of the module is provided as a sealed unit, and including the battery back up, rectification circuitry, charging circuitry as described above. The module also has a battery level indicator 96. A plurality of LEDs 98 are arranged along the centre of the module.

Figure 10 shows a lighting module 140 designed in the form of a standard light bulb. The module includes a secondary coil 142 for induction from a primary coil on a carrier 143. Light sources 144 are housed in chambers 145 at one end of the module. A fibre optic bundle 146 is provided in each light source with their end collectors arranged to convey light from the light source 144 through the fibres 147. The fibres pass convey light from the light sources 144 to a reflector 148 provided at the other end of the module. A lens 149 is also provided to enhance or direct the light from the module.

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Figures 11-14 shows are large lighting module 150 in accordance with the invention. An array of LEDs 151 is provided around two edges 152, 153 of a sealed unit, for illumination both outwards and downwards from the unit. As with the lighting modules described above, this module is a self contained sealed unit. It is provided with a secondary coil 154 for electromagnetic induction from a primary coil on a carrier as shown in Figure 1. Inside the unit, not shown are back-up batteries, as described before. So that the user can be confident that the back up battery is fully charged, a indicator light 156 is provided to indicate that the battery holds sufficient power. Again, as with the lighting modules described earlier, this lighting module 150 includes the rectification, change-over and battery charging circuits described above, not shown.

The invention is not intended to be restricted to the details of the above-described embodiment. For instance, the lighting modules and the carrier can be provided in many other shapes and designs for use in particular situations.